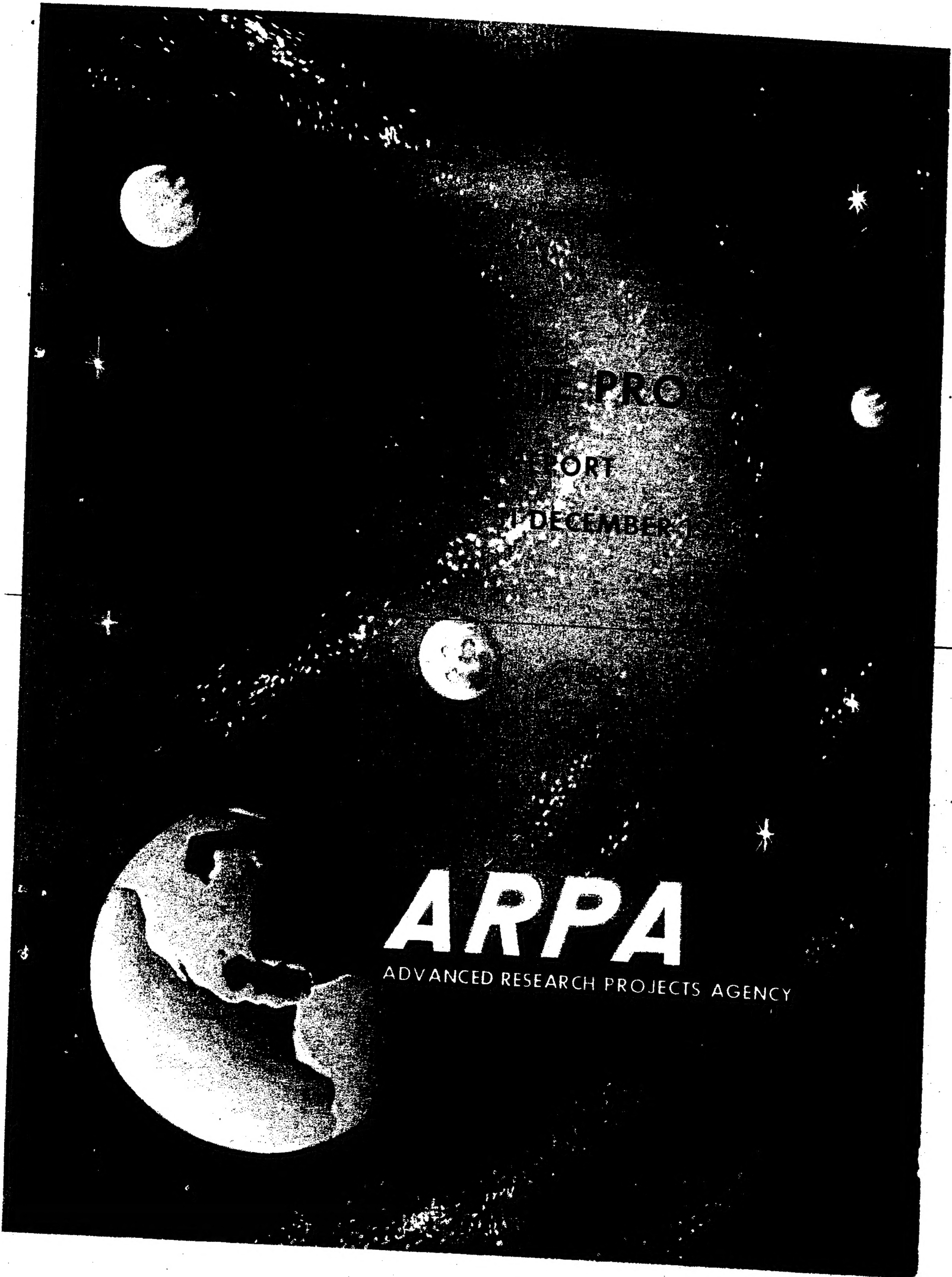

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ARPA

ADVANCED RESEARCH PROJECTS AGENCY

~~SECRET~~

ARPA

MILITARY SATELLITE PROGRAM

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794. THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

QUARTER ENDING 31 DECEMBER 1958

Department of Defense
Washington 25, D.C.

~~SECRET~~

ADVANCED RESEARCH PROJECTS AGENCY
WASHINGTON 25, D. C.

January 29, 1959

MEMORANDUM FOR THE SECRETARY OF DEFENSE

SUBJECT: Report of Progress in the Military Satellite Program During the Quarter Ending December 31, 1958.

This transmits the Report of Progress in the Military Satellite Program for the quarter ending December 31, 1958.

Work on basic satellite subsystems and the recoverable biomedical capsule, previously reported as part of the SENTRY Satellite System, has been redesignated DISCOVERER. Development of the photographic and electronic reconnaissance subsystems will continue under the SENTRY project. The Infrared Very Early Warning Satellite System, formerly Subsystem "G" Weapons System 117L, has been redesignated MIDAS.

Progress in these satellite projects is presented in summary format in the attached report. Revised launching schedules and highlights of events to date are briefly covered in the accompanying draft of your letter of transmittal of the report to the President.

Roy Johnson

Roy W. Johnson
Director

1 Incl
Report, subject
as above

~~SECRET~~

THE SECRETARY OF DEFENSE
WASHINGTON

January 29, 1959

Dear Mr. President:

I am forwarding herewith the report of Progress in the Military Satellite Program during the quarter ending December 31, 1958. This program is under the management direction of the Advanced Research Projects Agency, Department of Defense.

Work on basic satellite subsystems and the recoverable bio-medical capsule, previously reported as part of the SENTRY Satellite System, has been redesignated DISCOVERER. Development of the photographic and electronic reconnaissance subsystems will continue under the SENTRY project. The Infrared Very Early Warning Satellite System, formerly Subsystem "G" Weapons System 117L, has been redesignated MIDAS.

E

Launch of DISCOVERER I on January 21, 1959 was terminated during countdown due to accidental firing of the Ullage rockets. A new launch data has not yet been established.

2/25

DISCOVERER II launch is now scheduled for February 25, 1959. Preparations for launch of DISCOVERER III in March 1959 with a recoverable biomedical payload are substantially on schedule. Recovery tests of dummy biomedical capsules dropped from aircraft have been successfully completed.

With great respect, I am

Faithfully yours,

/Signed/ Neil McElroy

1 Incl
Report, as stated

The President

The White House

~~SECRET~~

FOREWORD

The Military Reconnaissance Satellite Program has been renamed with this issue. Inclusion of other than reconnaissance satellite projects has required broadening the title to Military Satellite Program. Programs contained herein, however, are limited to those which derived from the Military Reconnaissance (117L) program.

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DISCOVERER PROJECT

DISCOVERER FLIGHTS

DISCOVERER Flight I

Launch scheduled for January 13, 1959.

The first DISCOVERER flight was rescheduled from December to January 13, 1959. Flight operation crews are taking advantage of this additional time for further intensive training.

Facilities checkout and operation difficulties now being corrected.

Difficulties were encountered with the checkout of the THOR booster on the launch pad and the operation of blockhouse launch control and monitoring equipment. The booster checkout delay was caused by minor discrepancies in the booster and booster checkout equipment. Discrepancies were found in the guidance system checkout console for the DISCOVERER vehicle. An alternate procedure for the DISCOVERER guidance system checkout has been devised and system checkouts are continuing.

Payload: telemetry.

The first flight payload will consist of telemetry to provide data on performance of the booster and the orbit vehicle, and data concerning the space environment.

DISCOVERER Flight II

Launch scheduled for February 11, 1959

The second DISCOVERER launch is scheduled for February 11, 1959. The configuration, payload, and flight objectives are essentially the same as for the first flight. The first two flights will employ JP-4 fuel for satellite propulsion, with inhibited red fuming nitric acid as the oxidizer.

FACILITIES AND SITES

Launch

Equipment for first two flights in place.

All vehicle checkout and ground support equipment required for the first two flights is in place and checked out at Vandenberg Air Force Base.

Tracking

Ground station network ready for first flight.

The DISCOVERER ground station network is ready for the first flight. The interim Control Center at Palo Alto, including the interlocking computer, are operationally ready. All tracking stations are ready and interstation communication links, voice and teletype, are fully installed. The computer program, including provision for orbital tracking data from Space Track stations, was satisfactorily checked out. Equipment calibration and missile tracking exercises were conducted at all stations, and system runs successfully accomplished.

Excellent initial results from DISCOVERER tracking network.

The THOR Weapon System demonstration missile fired from Vandenberg Air Force Base on December 16, 1958 was successfully tracked by the DISCOVERER communications system with the exception of out of range Alaskan stations. The data acquired by the DISCOVERER network was better than that from any other tracking networ This was the first test of the network for tracking a missile in flight, and the results were very gratifying.

GENERAL

Satellite Airframe Subsystem

First two DISCOVERER flight test vehicles ready for launch.

The first two DISCOVERER flight test vehicles have been successfully subjected to hot firings at the Santa Cruz Test Base with all flight equipment installed and operating. Both vehicles were accepted by the Air Force and are at Vandenberg Air Force Base. Final adjustments for flight have been accomplished.

Third DISCOVERER flight test vehicle will use UDMH configuration engine.

Flight objectives now require the use of higher-performance UDMH fueled satellite propulsion vehicles on the third flight rather than the fifth, as originally scheduled. The satellite airframe design has been modified for compatibility with this engine.

Flight vehicles marked "ARPA DISCOVERER."

Vehicle markings have been changed so as to identify the vehicles as "ARPA DISCOVERER."

DISCOVERER design refinements under study.

Various investigations are underway to further refine the present design and reduce the weight of the DISCOVERER vehicles. Aluminum wiring is being studied as a substitute for the copper wire now used. The weight of the wiring harness could be reduced 30 percent if the substitution proves practical.

DISCOVERER hardware tests are satisfactory.

Major hardware testing of many major components has been satisfactorily completed, including DISCOVERER-THOR separation tests, tank corrosion tests, destruct tests, and qualification tests.

Satellite Propulsion Subsystem

Engine production on schedule.

Engine deliveries are on schedule. As of December 26, 1958, ten engines were delivered, two of JP-4 and eight of UDMH configuration.

Variable performance of UDMH engines under investigation.

Performance variations among UDMH fueled engines have caused postponement of the engine reliability program until the cause has been determined. Fuel and oxidizer temperature deviation could be the cause of the variations. A study is underway to determine how propellant temperatures affect engine performance.

UDMH engine qualification program is underway.

The manufacturer is conducting a UDMH engine qualification program, using a test installation which simulates installation in the flight test vehicle. Engine firings began in late November 1958 and eight hot firings have been conducted to date, of which the last two were 120 seconds duration each.

Auxiliary Power Subsystem

Static power inverter design problems solved.

Difficulties with static (electronic) power inverters have been essentially eliminated. Satisfactory 400 and 2000 cycle static inverters have been developed for the second and subsequent flights. Inverter deliveries are somewhat behind schedule due to design changes, but immediate requirements are being met. Efforts will continue toward further refinement of the static inverter design. A conventional rotary inverter of proven performance but greater weight will be used on the first flight.

Satellite Guidance and Control Subsystem

Guidance subsystems available for first four DISCOVERER flights.

Guidance and control equipment is on hand for the first four flights. Design refinements are being made in the equipment for use on subsequent flights for increased performance and reliability.

Data Handling Subsystem

Ground data handling concepts established.

The basic concepts for ground data handling systems have been established in detail. Development and acquisition of ground data handling equipment has begun.

Ground data handling subsystem on schedule.

Development of the Data Processing System is proceeding on schedule. A detailed report reflecting the initial systems design, stage of hardware development, and immediate future plans was prepared and submitted to the Rome Air Development Center.

A system design inspection will be held in March, 1959.

A System Design Review of the Data Processing System was held on November 13 and 14, 1958 at the Ramo-Wooldridge Denver facility. A system design inspection will be held at the Ramo-Wooldridge Denver facility in early March 1959. An integrated picture of the Data Processing System will be presented to the Air Force at the time of this inspection.

Specifications for photo-optical data processing equipment completed.

Specifications for the Data Processing System photo-optical equipment were submitted for review to the Rome Air Development Center. They will then be issued to the contractor for equipment procurement. Performance specifications for the initial configurations of the ferret, photo data reduction and communications subsystems have been prepared for submission to the Rome Air Development Center.

Biomedical Recovery Program

Third DISCOVERER flight vehicle being readied on schedule.

Modification and checkout of the third DISCOVERER flight vehicle is substantially completed. This vehicle will be shipped to Santa Cruz test site during January for a hot firing of the modified, UDMH burning engine. The March launch date is expected to be met.

First and second biomedical capsules received by Lockheed.

The first biomedical recovery capsule has been received (Figure 1) and is being used for training and checkout purposes (Figure 2). The second capsule, for use in the first biomedical flight, has also been received. This second capsule will be installed in the third DISCOVERER vehicle at Santa Cruz Test Base.

The first four biomedical vans have been received at Vandenberg Air Force Base, and the remaining three are virtually completed. Biomedical flight countdown procedures have been completed.

Six biomedical air recovery tests completed with good results.

Six attempts have been made to air recover dummy biomedical capsules dropped from B-47 aircraft. The six capsules were equipped with the silvered parachute, the radar target chaff, and the radio homing beacon. The first test consisted of two drops from 40,000 feet altitude. RC-121 radar tracking aircraft successfully located and tracked both capsules throughout their entire descent, vectoring the C-119 recovery aircraft to the precise intercept area.

The first biomedical capsule was recovered by the C-119 on the sixth attempt at an altitude of 7,500 feet. The second capsule was recovered on the first pass at 13,000 feet. Of the other four drops made, three of the capsules were recovered successfully. The fourth capsule was lost due to failure of the capsule borne radio homing beacon.

Hawaii Recovery Control Center being readied.

Space has been acquired at Hickam Field, Hawaii, for the DISCOVERER Recovery Operations Control Center. The Control Center is being readied for use and will be available on schedule for the third flight. A full recovery system rehearsal will be conducted in conjunction with the March launch of DISCOVERER III.

SENTRY PROJECT

SENTRY FLIGHTS

SENTRY program reoriented

The SENTRY program is being reoriented. Specific program objectives and firing schedules are now being developed. Development plans are being prepared by AFBMD based on results of briefings presented to ARPA and the Air Staff on December 16 and 17, 1958. When the new development plans are approved, specific progress toward new objectives will be reported.

Primary purpose of SENTRY and DISCOVERER.

The primary purpose of the SENTRY program is to obtain military intelligence information by photographic and electronic means. The ATLAS launching vehicle will be utilized to place payloads containing this equipment in orbit. The newly designated DISCOVERER program has as its primary purpose the development of new systems and techniques for employment in the production and operation of space vehicles. Initially, the primary objective will be to test components and subsystems. The THOR vehicle will be used in early launches. Both SENTRY and DISCOVERER will utilize the same basic satellite vehicle, although on-orbit weights will vary due to payload differences and booster capabilities.

FACILITIES AND SITES

Launch

Point Arguello launch complex contract awarded on December 30, 1958.

The contract for the launch complex at Point Arguell was awarded on December 30, 1958. Plans and specifications for the construction of the guided missile assembly building were forwarded to the Los Angeles District Engineer on November 10, 1958. Permission to advertise was withheld pending studie by ARPA concerning the location of the facility. Siting on Vandenberg Air Force Base was approved by ARPA on December 19, 1958 and funds are in the process of being released. Bid advertising will be completed in time to permit contract award on February 5, 1959.

Completion of tracking station at Vandenberg scheduled for August 1959.

The contract for the permanent tracking and data acquisition station at Vandenberg Air Force Base was awarded on December 8, 1958. Completion is scheduled for August 1959.

Hawaii station to be completed in June 1959.

The construction required to complete the Hawaii tracking and data acquisition station is scheduled for completion in June 1959.

Northwest, Central and Northeast stations in deferred status.

Design of the Northwest, Central, and Northeast tracking and data acquisition stations has been placed in a deferred status pending realignment of the technical concept of the program.

GENERAL

Basic subsystem hardware for SENTRY is being developed under the DISCOVERER project discussed above. Reference is made thereto for description of basic SENTRY airframe, propulsion, auxiliary power, guidance and data handling subsystem development.

Auxiliary Power Subsystem

Solar and nuclear auxiliary power development accelerated.

Development of Advanced Auxiliary Power systems (APU) has been accelerated. Emphasis is being placed on solar and nuclear systems. High energy storage battery systems are being developed for a back-up capability.

Solar power unit design one-third complete.

The detail design of the Solar APU for the SENTRY vehicle is one-third complete. This unit will provide a minimum of 200 watts average continuous power under least favorable conditions and 600 watts under most favorable conditions. Design of the Solar APU Telemeter, which will transmit data on Solar APU operation for the life of the unit, has begun.

High energy batteries being designed for backup.

The design concept for a high energy Hydrogen-Oxygen battery auxiliary power system has been completed and detailed design criteria are being established. The design output is 250 watts, but much higher output is expected. A high-energy Borohydride-Oxygen battery is also under development. A 5-watt laboratory unit is completed and plans are finished for a 100-watt prototype unit.

Visual Reconnaissance Subsystem

Development of visual reconnaissance equipment is well advanced.

Current planning is for launch of photo reconnaissance SENTRY satellites into 300 mile high circular polar orbits from Vandenberg Air Force Base. The airborne and ground components of the visual reconnaissance system are in an advanced state of development.

Model of visual subsystem payload successfully tested.

The developmental model of the complete visual payload subsystem was operated successfully during this report period. The first photographs attained resolution exceeding 140 lines per millimeter. Thermal tests revealed no problems in maintaining the 70° F temperature desired for processing of the film within the satellite.

Satellite Ferret Reconnaissance Subsystem

Prototype ferret components to be tested in aircraft.

Current planning is for launch of ferret-equipped SENTRY satellites into circular, 300-mile altitude polar orbits from Vandenberg Air Force Base using ATLAS boosters. Flight testing of prototype ferret components will begin in January 1959 using a modified DC-3 aircraft. The design of this ferret equipment (F-1) makes maximum use of commercially available components for the earlier availability. The system will be tested in flights over radars in the New York City area.

Ferret temperature tests satisfactory.

Ground testing of F-1 ferret equipment is proceeding satisfactorily. Thermal mockup tests reveal no serious temperature problems. The equipment was subjected to conditions simulating noon-to-midnight and twilight orbits.

Ferret development on schedule.

All work on the ferret (F-2) equipment is on schedule. In comparison to the F-1 series where early availability was the prime consideration, the F-2 series is designed for reduced weight, increased performance, and greater reliability.

MIDAS PROJECT

GENERAL

Infrared attack alarm system is redesignated MIDAS.

The former WS 117L infrared Attack Alarm System (Subsystem "G") has been redesignated Missile Defense Alarm System (MIDAS) and is now a separate project. Studies are in progress to reorient this project and achieve early orbital flight tests.

Successful tests of infrared emanations from rocket engines have been made at the Air Force Missile Test Center.

During this reporting period, flights of infrared instrumented B-47 aircraft were performed to gain data on the infrared emanations from ballistic missiles launched from the Air Force Missile Test Center. After initial instrumentation troubles were corrected, the tests were successful. The rocket engine of the ATLAS 10B was tracked by infrared for the entire powered flight.

Two MIDAS infrared scanners are nearing completion.

Two flight configuration MIDAS infrared scanners are nearly completed. Testing and evaluation of the units should begin in early 1959.

STATUS OF FUNDS - ALL PROJECTS

As of December 31, 1958
(in millions)

Fiscal Year 1958 and Prior Years Program	Fiscal Year 1959 Program	Fiscal Year 1959 Obligations
$84.1	$228.8 *	$105.6

* DISCOVERER $107; SENTRY $108; MIDAS $13.8.

MILITARY SATELLITE PROGRAM

GLOSSARY

DISCOVERER FLIGHTS

DISCOVERER I:

Scheduled Launch Date: January 13, 1959
Booster: THOR #160, IRBM
Gross Weight: 113, 700 lbs
Payload Weight: 70 lbs
Altitude: 220 Statute miles
Payload: Telemetry
Subsystems: Test of Booster/Vehicle Orbital Capability

Second Stage: DISCOVERER Vehicle
On-Orbit Weight: 1, 328 lbs
Propulsion: XLR81-Be-3 Rocket Engine
Fuel: JP-4 Inhibited Red Fuming Nitric Acid
Flight Characteristics: Ballistic trajectory to Orbit

DISCOVERER II:

Scheduled Launch Date: February 11, 1959
Booster: THOR #163, IRBM
Gross Weight: 113, 802 lbs
Payload Weight: 70 lbs
Altitude: 220 Statute miles
Payload: Telemetry
Subsystems: Test of Booster/Vehicle Orbital Capability

Second Stage: DISCOVERER Vehicle
On-Orbit Weight: 1, 328 lbs
Propulsion: XLR81-Be-3 Rocket Engine
Fuel: JP-4 Inhibited Red Fuming Nitric Acid
Flight Characteristics: Ballistic trajectory to Orbit

DISCOVERER III:

Scheduled Launch Date: March 18, 1959
Booster: THOR #170, IRBM
Gross Weight: 114, 906 lbs
Payload Weight: 195 lbs
Altitude: 195 Statute miles
Payload: Mark I biomedical recovery capsule
Subsystems: Airframe, Propulsion, Auxiliary Power, Guidance and Biomedical

Second Stage: DISCOVERER Vehicle
On-Orbit Weight: 1, 651 lbs
Propulsion: XLR81-Be-5 Rocket Engine
Fuel: Unsymmetrical Di-Methyl Hydrazine/Inhibited Red Fuming Nitric Acid
Flight Characteristics: Ballistic ascent trajectory with Orbital boost at Apogee

SENTRY FLIGHTS

SENTRY project flight schedules and objectives are being realigned and no approved schedules are available at this time. The SENTRY project will consist of visual and ferret reconnaissance. The booster will be the ATLAS ICBM and the second stage will consist of a SENTRY vehicle. Second stage propulsion will be by a Bell Aircraft XLR-Be-5 rocket engine using Unsymmetrical Di-Methyl Hydrazine/Inhibited Red Fuming Nitric Acid fuel.

MIDAS FLIGHTS

The MIDAS program is undergoing realignment and flight schedules are not available. The MIDAS program will consist of infrared reconnaissance. The booster will be the ATLAS ICBM.

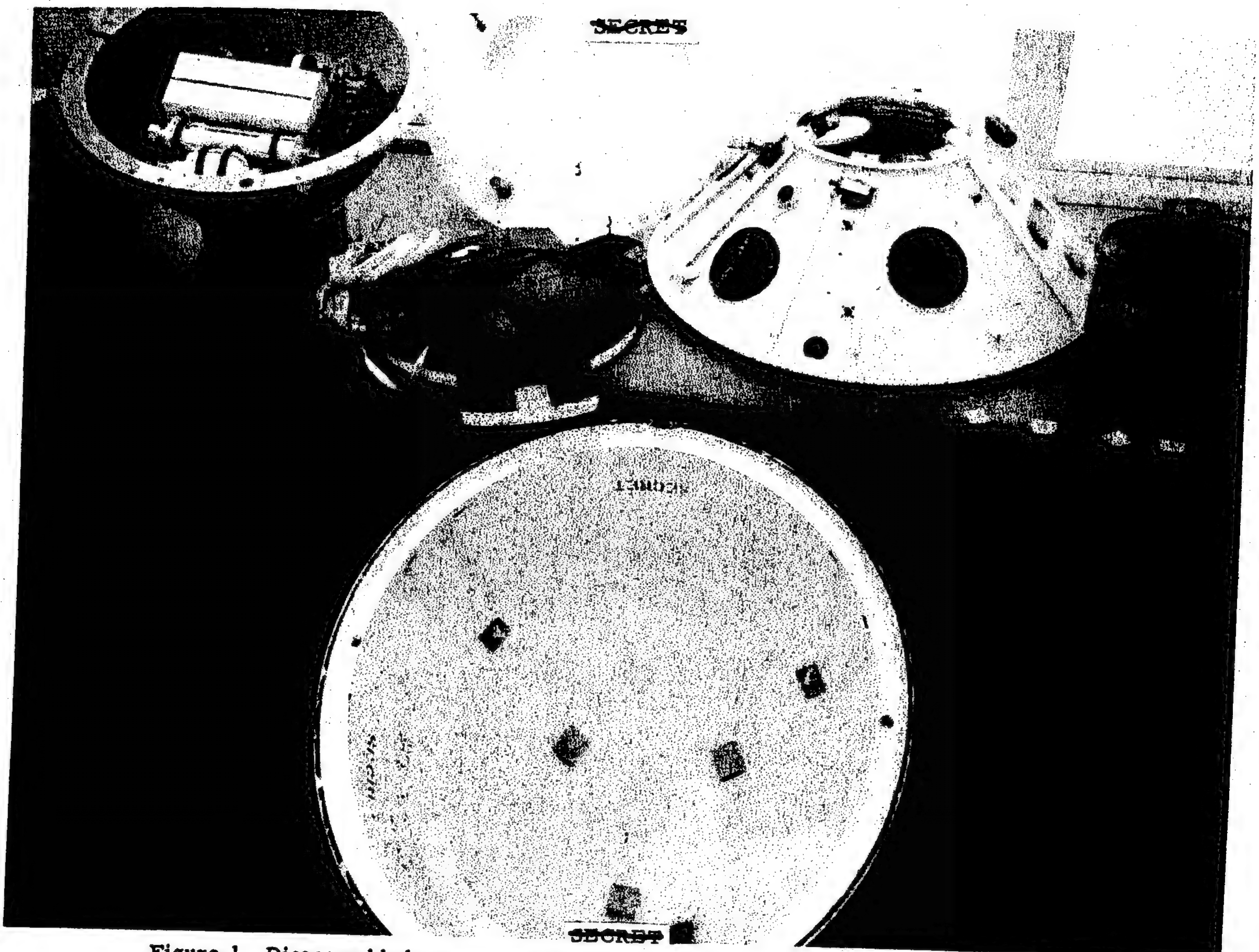

Figure 1 Disassembled component assemblies of DISCOVERER Mark I Biomedical Recovery Capsule.

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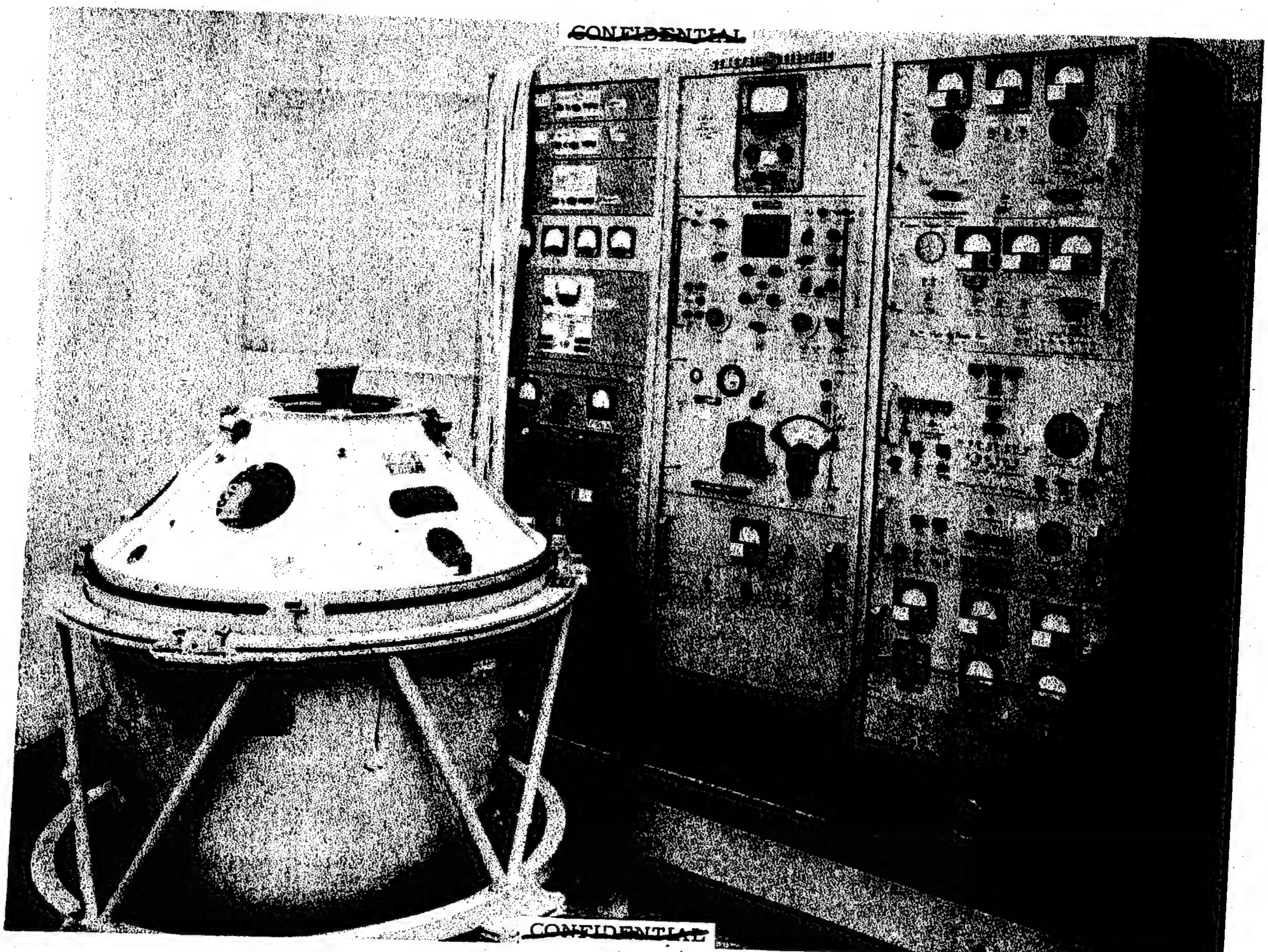

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Figure 2 Mark I Biomedical Recovery Capsule standing beside Laboratory Checkout Console.

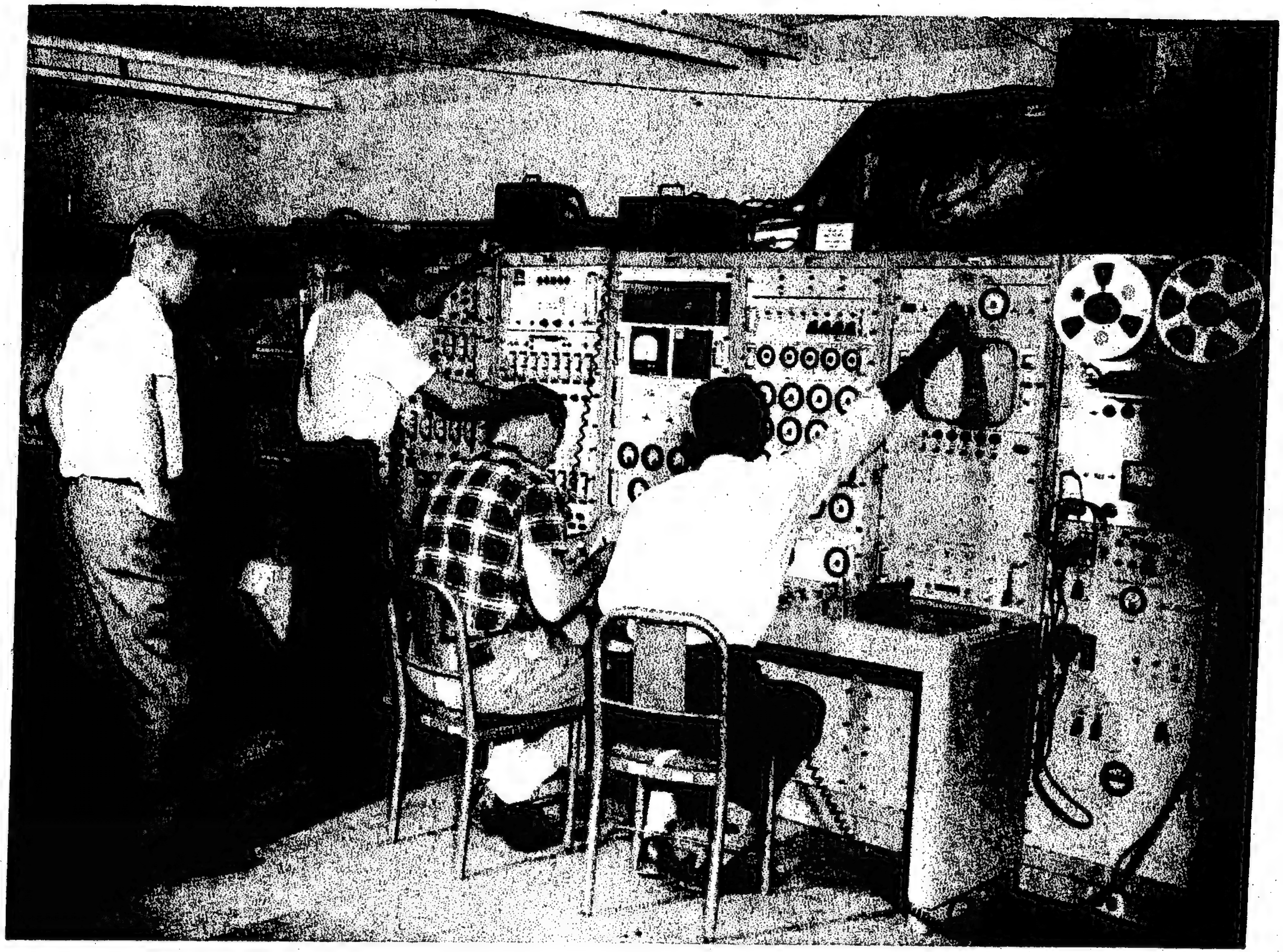

Figure 3 A portion of the checkout console for the DISCOVERER satellite. This equipment is installed in the blockhouse adjoining launch pad 4 at Vandenberg Air Force Base.

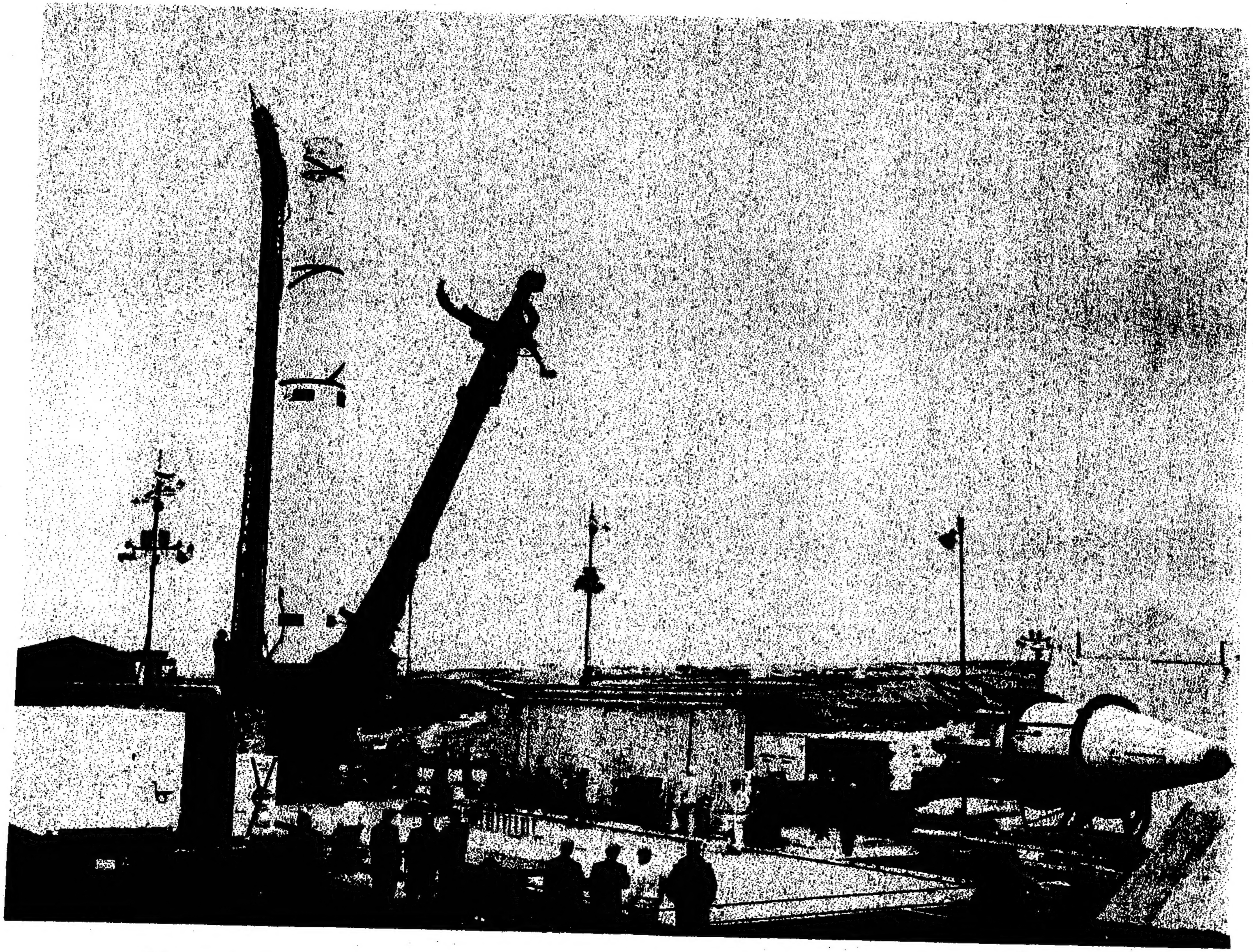

Figure 4 Transporter-erector being raised preparatory to lowering Thor missile 160 for mating with DISCOVERER satellite flight test vehicle.

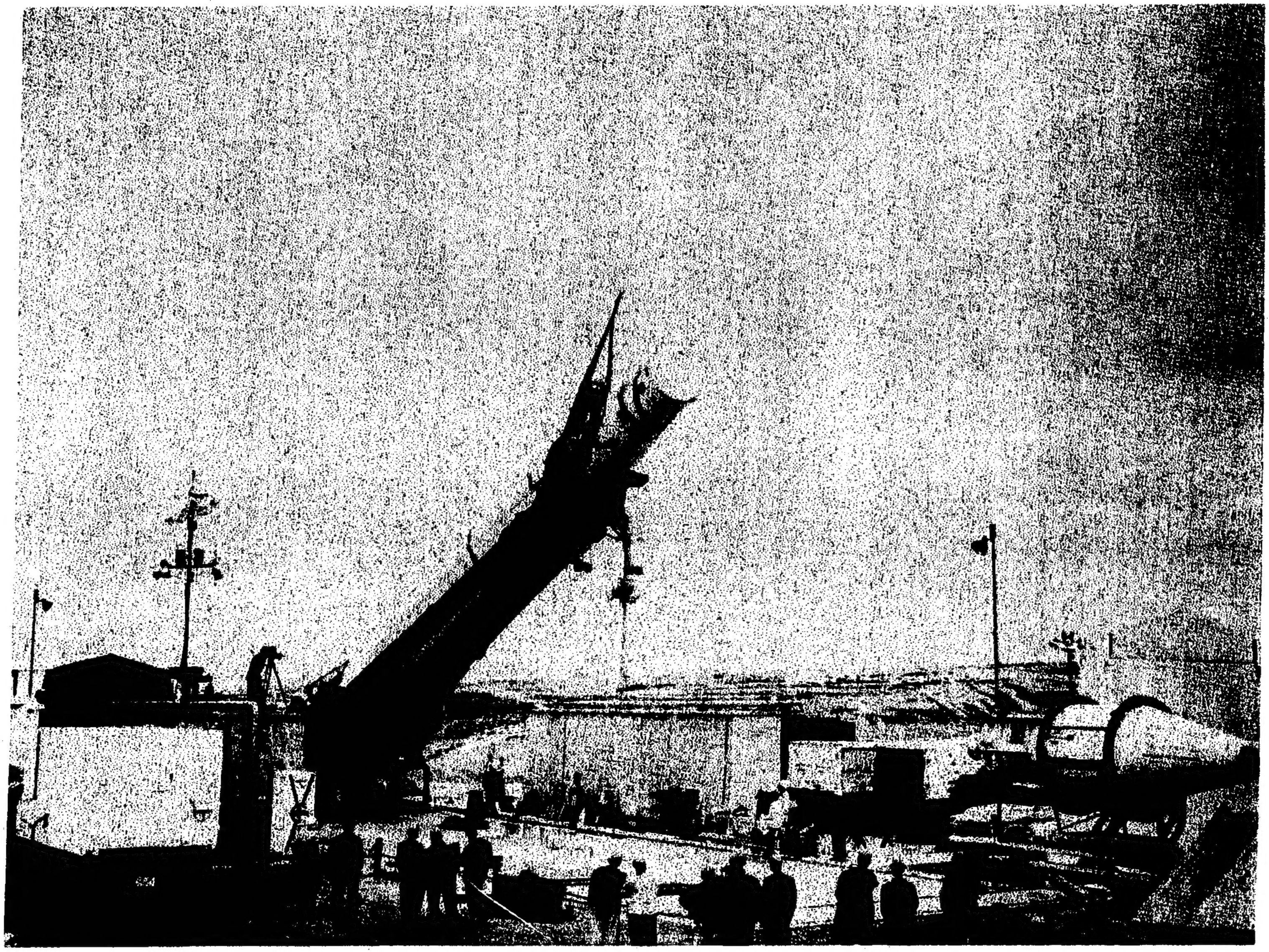

Figure 5 Thor booster lowered to horizontal position for mating with the DISCOVERER satellite flight test vehicle.

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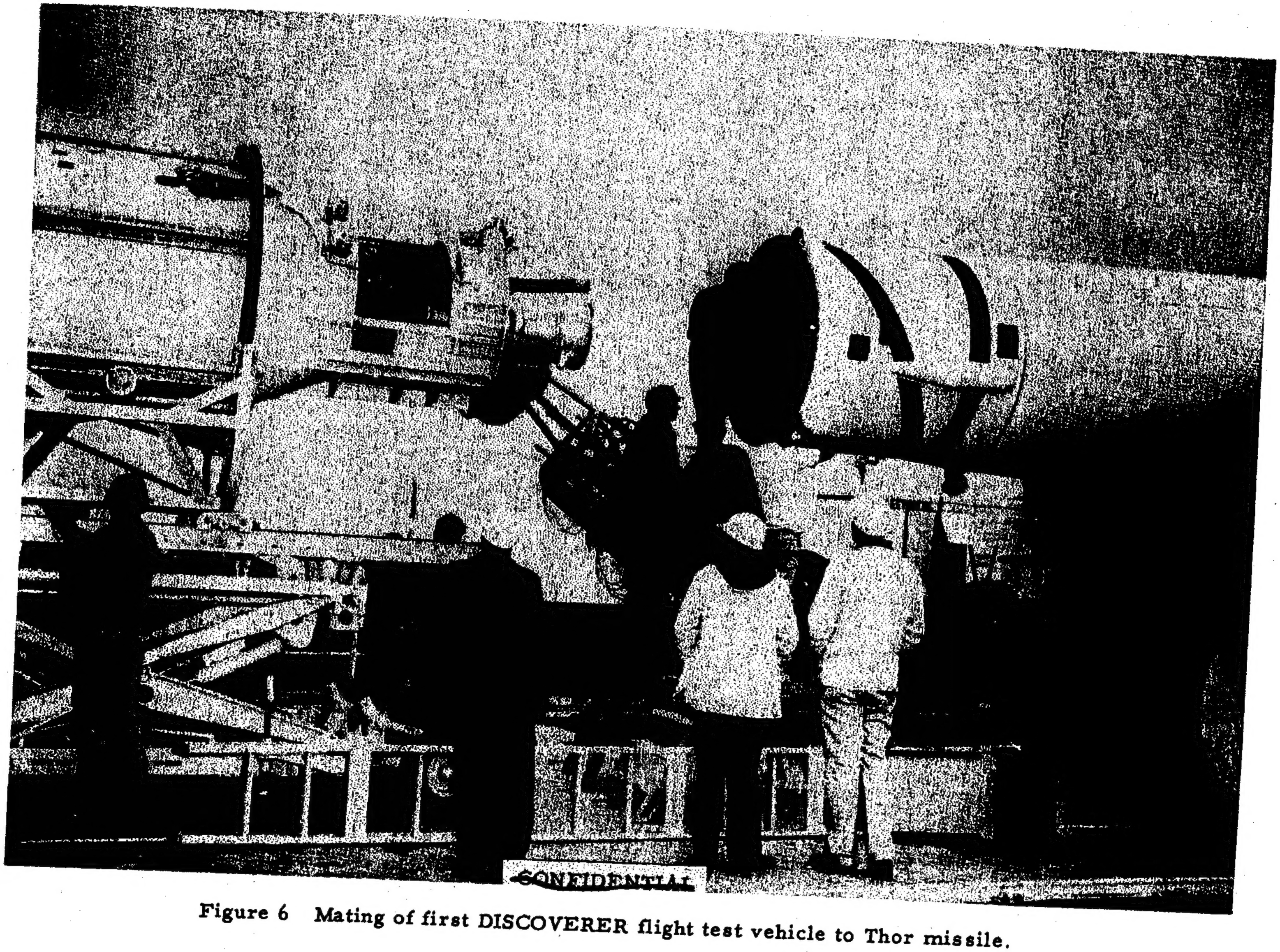

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Figure 6 Mating of first DISCOVERER flight test vehicle to Thor missile.

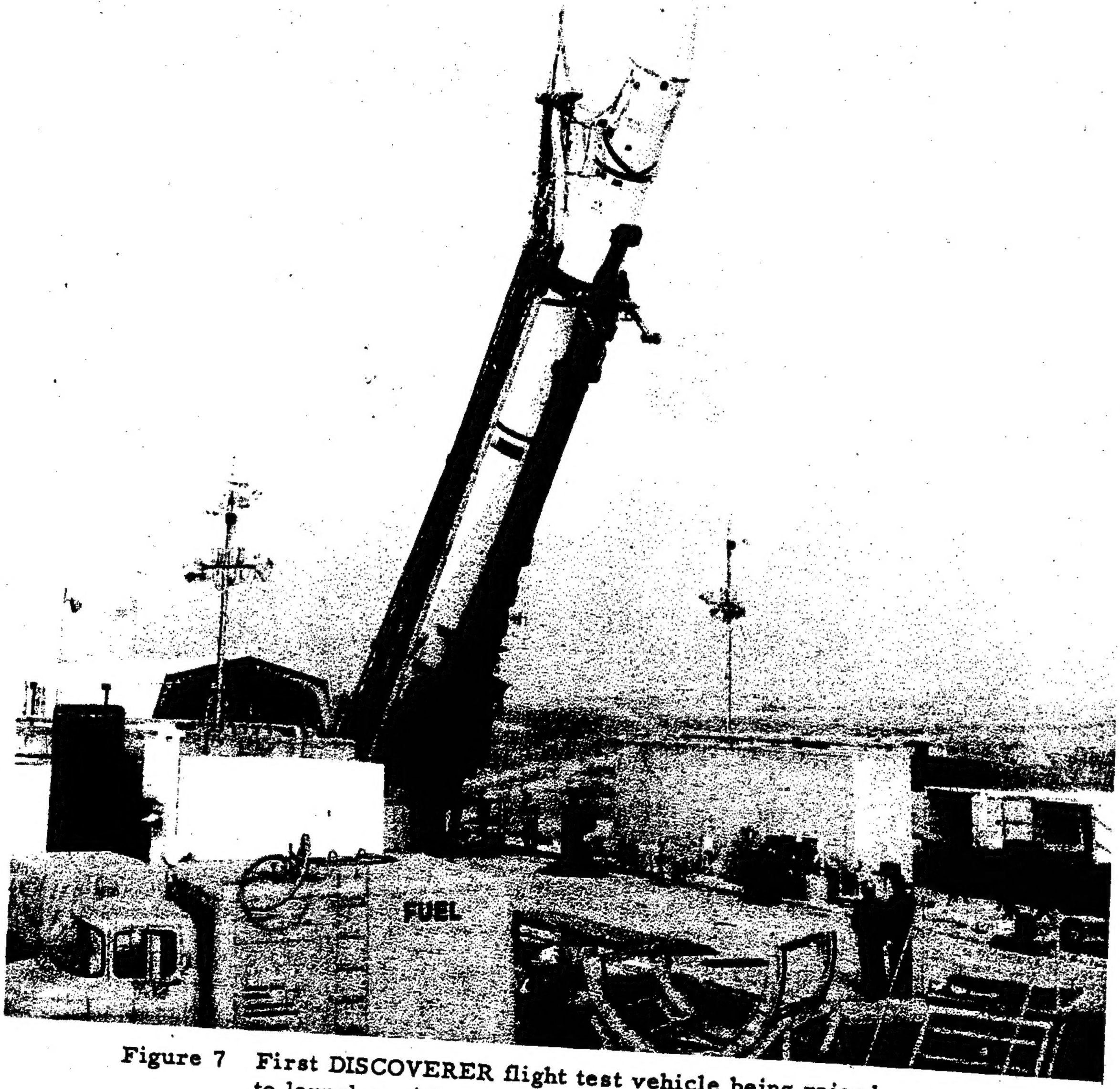

Figure 7 First DISCOVERER flight test vehicle being raised to launch position on pad 4 Vandenberg Air Force Base.